

WHAT IS CLAIMED IS:

1. A method of making a heterojunction bipolar transistor, said method comprising the steps of:

5 forming a mask layer on a compound semiconductor film by a photomask for forming an emitter mesa; and

forming an emitter mesa by wet-etching said compound semiconductor film by said mask layer;

10 wherein said photomask has a pattern thereon for forming said emitter mesa;

15 wherein said pattern is defined by a first area portion associated with a shape of said emitter mesa to be formed, and a plurality of second area portions; and

wherein each of said second area portions has first and second sides meeting each other to form an acute angle therebetween, and a third side in contact with said first area portion.

2. A method of making a heterojunction bipolar transistor according to claim 1, wherein said first area portion is defined by a first pair of sides extending in a first direction, and a second pair of sides extending in a second direction intersecting said first direction; and

20 wherein each of said second area portions is arranged such that said third side is in contact with one of said first pair of sides of said first area portion.

25 3. A method of making a heterojunction bipolar transistor according to claim 1, wherein said first area

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portions is defined by a first pair of sides extending in a first direction, and a second pair of sides extending in a second direction intersecting said first direction; and

5 wherein said second area portions are arranged such that said third sides of said second area portions are in contact with said respective first and second pairs of sides.

4. A method of making a heterojunction bipolar transistor according to claim 1, wherein each of said second area portions is formed into a triangle defined by said first to third sides; and

10 wherein said first side of each second area portion is oriented in a direction in which one of said first and second pairs of sides extends.

15 5. A method of making a heterojunction bipolar transistor according to claim 1, wherein said emitter mesa has a first pair of sides extending in a predetermined direction, and a second pair of sides extending in a direction intersecting said predetermined direction.

20 6. A method of making a heterojunction bipolar transistor according to claim 5, wherein an inverted mesa structure is formed at said first pair of sides in said emitter mesa and a normal mesa structure is formed at said second pair of sides in said emitter mesa in said wet-etching step.

25 7. A method of making a heterojunction bipolar transistor according to claim 1, wherein said mask layer has a pattern with a pair of edges extending in crystal axis

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[011] direction of said compound semiconductor film.

8. A method of making a heterojunction bipolar transistor according to claim 1, wherein said compound semiconductor film includes an InP semiconductor.

5 9. A method of making a bipolar transistor according to claim 8, wherein said etching mask is made of resist.

10 10. A method of making a heterojunction bipolar transistor according to claim 8, further comprising a step of forming an InGaAs base region essentially constituted by eight sides.

15 11. A method of making a heterojunction bipolar transistor according to claim 8, wherein said mask layer has a pair of edges extending in crystal axis [011] direction of said compound semiconductor film; and

16 said method further comprising the steps of:  
forming said III-V compound semiconductor film prior to said step of forming a mask layer;

17 forming a base region including an InGaAs semiconductor after said step of forming an emitter mesa; and

20 forming an emitter electrode and a pair of base electrodes in a self-alignment fashion with respect to said emitter mesa after said step of forming a base.

21 12. A method of making a heterojunction bipolar transistor, said method comprising the steps of:

22 forming on a compound semiconductor film a mask layer for forming an emitter mesa; and

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1 forming an emitter mesa by wet-etching said compound semiconductor film by using said mask layer;

5 wherein said mask layer has a pattern for forming said emitter mesa; wherein said pattern has a first pair of sides extending in a predetermined direction, a second pair of sides extending in a direction intersecting said predetermined direction, and a mask portion extending from one side of said first pair of sides; and wherein said mask portion has a side extending in a direction of a line inclining toward said side of said first pair of sides.

10 13. A method of making a heterojunction bipolar transistor according to claim 12, wherein said mask layer has another mask portion thereof extending from the other of said first pair of sides, and wherein said the other mask portion has an edge extending in a direction of a line inclining toward the other of said first pair of sides.

15 14. A method of making a heterojunction bipolar transistor according to claim 12, wherein said mask layer has another mask portion therein extending from one side of said second pair of sides, and wherein said the other mask portion has a side thereof extending in a direction of a line inclining toward the side of said second pair of sides.

20 15. A heterojunction bipolar transistor comprising:  
25 a first mesa including a collector and a base, said collector being provided on a substrate, and said base being

provided on said collector, said base including compound semiconductor; and

a second mesa including an emitter, said second mesa being provided on said first mesa, said second mesa having  
5 a first pair of sides extending in a predetermined direction and a second pair of sides extending in a direction intersecting said predetermined direction, and said emitter containing a compound semiconductor;

wherein said first pair of sides of said emitter are provided with an inverted mesa structure and said second pair of sides are provided with a normal mesa structure.

16. A heterojunction bipolar transistor according to claim 15, wherein said first pair of sides extends in a direction of the crystal axis [011] of a semiconductor crystal of said emitter.

17. A heterojunction bipolar transistor according to claim 15, wherein said emitter contains an InP semiconductor.

18. A heterojunction bipolar transistor according to claim 15, wherein said base contains an InGaAs semiconductor and has a shape basically constituted by four pairs of sides.

19. A heterojunction bipolar transistor according to claim 15, wherein said first mesa has edges in a normal mesa form.

20. A heterojunction bipolar transistor according

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to claim 15, further comprising:

an emitter wiring lead having a portion extending in said predetermined direction so as to extend to pass over one side of said second pair of sides of said emitter, said emitter wiring lead being electrically connected to said emitter; and

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a base wiring lead having a portion extending in said predetermined direction, said base wiring lead being electrically connected to said base.

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